

**PHYTOTOXICOLOGY ASSESSMENT
INVESTIGATION IN THE VICINITY OF
WELCO PRECISION WEIGHTS
563 KENILWORTH AVENUE NORTH,
HAMILTON - 1991**

NOVEMBER 1992



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**Phytotoxicology Assessment Investigation in the Vicinity of
Welco Precision Weights, 563 Kenilworth Avenue North, Hamilton - 1991**

Phytotoxicology Section
Air Resources Branch

ARB No. ARB - 068 - 92 - Phyto
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Background

Lynn Kergan, of the Ministry's Hamilton Office, West Central Region, requested that the Phytotoxicology Section conduct a survey of soils in the vicinity of Welco Precision Weights. This small company manufactures lead weights used to balance tires. An integral part of the process involves the melting of lead, then pouring it into molds. Because of the nature of emissions associated with the lead melting process, the Hamilton Office requested the survey to determine if emissions had adversely affected the soils of the local environment.

In response to the request, Mr. G. Vasiloff of the Phytotoxicology Section visited the area and conducted a soil survey in the vicinity of Welco on 13 September 1991. Welco is in an area of heavy industry, although some residential housing is located nearby. The immediate area is dominated by the Dofasco steel company which has operations to the east and north of the Welco location. Adjacent to the southwest, there is residential housing and commercial buildings.

Phytotoxicology Soil Survey

Triplicate samples of undisturbed 0-5 cm lawn soil were collected at 7 sites in the vicinity of the Welco operation. Control soil samples were collected from an urban residential property at 146 Adeline Street. Because Dofasco and other industries dominate much of the properties to the east, north and west of Welco, the choice and location of the survey sites was somewhat restricted. The locations of the soil sample sites and their spatial relationship to Welco are shown in Figure 1.

All soil samples were collected in compliance with the methodology outlined in the Phytotoxicology Investigation Procedures Manual. During the collection process, new rubber latex gloves were worn by the Phytotoxicology investigator at each site to avoid contamination

of the samples. At all sample sites, each of the sub-samples contained over 30 individual soil cores. The samples were delivered to the Phytotoxicology laboratory to be processed in preparation for chemical analysis. Processed samples were submitted to the Ministry's Inorganic Trace Contaminants laboratory for analysis of total lead, zinc, cadmium, nickel, copper, molybdenum, vanadium, chromium, cobalt, manganese, strontium, sodium, aluminum and iron in the soils. Tests to determine soil pH and electrical conductivity were also requested.

Two of the survey sites (15 and 16) were established on residential properties located immediately next door to the Welco factory. At Site 15 (571 Kenilworth Ave. North), the residents described years of suffering continuous emissions of heavy black, odoriferous smoke from Welco. The smoke is expelled from a wall-mounted exhaust fan located on the north side of the Welco factory. In the last several years, one of the residents has experienced soreness of the nose lining and attributes the problem to the smoke emissions from Welco. This health-related complaint was related to Lynn Kergan to notify the local Medical Officer of Health. On a least one occasion, the volume of smoke emanating from Welco prompted security people at Dofasco to call the Fire Department, under the false assumption that the Welco building was on fire.

Site 16 (569 Kenilworth Ave. North) is a rented residential property next door to Welco. The property is owned by Welco. Smoke emissions from the exhaust fan on the factory wall pass over the residential backyard where the family has a vegetable garden, swimming pool and clothes line. In addition to collecting 0-5 cm soil from the lawn portion of the backyard, triplicate samples of disturbed garden soil from a depth of 0-15 cm were obtained for chemical analysis. Figure 2 is a sketch which shows positions of Sites 15 and 16 in relation to Welco and the lawn and garden soil sample locations on each property.

Chemical Analysis Results

Concentrations of lead and 13 other elements examined in the survey soils are shown in Table 1. Also shown are the concentrations in the 0-5 cm lawn soil and 0-15 garden soil from the control location. Included in the table are the Phytotoxicology Upper Limit of Normal (ULN) guidelines for 0-5 cm urban soil. No ULN guidelines have been established for soil collected from a depth of 0-15 cm. The rationale behind the derivation of the ULN guidelines and their interpretation is provided in Appendix I. Element concentrations in the table that exceed ULN guidelines have been underlined.

Lead, Zinc, Cadmium, Copper, Chromium and Iron

Excessive concentrations of metals were found at only 2 of the 7 survey sites (15 & 16). At Site 15, concentrations of lead, zinc, copper and chromium in 0-5 cm soil exceeded their respective ULN guidelines. At Site 16, excessive levels of lead, zinc, copper, chromium, as well as cadmium, were present in the lawn soil. Sites 17 and 18, the two next closest sampling sites to Welco, also had the next highest concentrations of lead, zinc, cadmium, copper and chromium, although the ULN's were not exceeded. At the other 4 survey sites,

values of these elements were not excessive, but all were elevated compared to the controls.

Although ULN guidelines have not been established for 0-15 cm urban soil, concentrations of lead, zinc, cadmium, copper, chromium and iron in the garden soil at Site 16 exceeded the 0-5 cm guidelines and were sharply elevated compared to the control garden values.

Manganese

Manganese concentrations in excess of the 700 ppm ULN guideline were present in the 0-5 cm soils at all 7 survey sites. Values of this element were highest at Sites 15 and 16. However, the ULN guideline is currently under review because of the high variability of this element in soil. Manganese concentrations in the 1000 ppm range are encountered in both urban and rural soil that has not been exposed to a known manganese source. Since concentrations of manganese were highest at Sites 15 and 16, it appears likely that Welco was, at least, a contributing source.

Other Elements

Concentrations of nickel, molybdenum, vanadium and cobalt were below ULN guidelines for 0-5 cm soils at all survey sites. Guidelines are not currently available for aluminum, strontium, and sodium. Concentrations of nickel, molybdenum, vanadium and sodium tended to be marginally elevated at the four sample sites closest to Welco. There was no relationship between the concentrations of cobalt, aluminum and strontium in soil and distance and direction from the Welco factory.

Electrical Conductivity and pH of Soil

Electrical conductivity and pH tests were conducted on all soil samples. Electrical Conductivity (EC) is a measure of soluble salts in the soil. The EC increases as the soluble salt concentration increases. Elevated concentrations of soluble salt can adversely affect or kill plants by interfering with the mechanism of water uptake from the soil. Tests for pH indicate the acidity or alkalinity of soils on a scale from 0 to 14. Values below 7 are considered acidic while those above are alkaline.

Test results for EC and pH are summarized in Table 2. The EC at all survey sites was relatively low and within a range that is suitable for most plants. Although there was some variability in soil pH values, all were within a range considered acceptable.

Summary

Lawn soils from a sample depth of 0-5 cm were collected for analysis at 7 survey sites in the vicinity of Welco Precision Weights, Hamilton. Excessive concentrations of lead,

zinc, copper and chromium occurred at two sites (15 & 16) located very close to the Welco factory. Cadmium and iron concentrations were excessive at Site 16. Elevated levels of nickel, molybdenum, vanadium and sodium were also detected at Sites 15 and 16.

Eye witnesses who live at a nearby property have observed black, odoriferous smoke emissions emanating from the Welco building for a number of years. Whenever the emissions occur, the smoke often travels at ground level at Sites 15 and 16. Based on chemical analysis, it was concluded that the excessive concentrations of lead, zinc, cadmium, copper, chromium and iron and elevated concentrations of nickel, molybdenum, vanadium and sodium found in the lawn and garden soils at Sites 15 and 16 occurred as a result of emissions from Welco Precision Weights.

The presence of excessive lead concentrations in residential soil at Sites 15 and 16 is of concern. Apparently, small children play in the backyard, swim in the pool and the family consumes vegetables from the garden. An immediate review of abatement strategy is warranted, and because of the potential health risk of exposure to lead-contaminated soil, the residents should be informed of the results of this survey and site remediation (at least at Site 16) should be considered.

TABLE: 1

Concentrations¹ of 14 Inorganic Elements in Soil
Collected in the Vicinity of Welco Precision Weights, Hamilton 1991

Survey Site Number	Distance & Direction from Welco	Concentration (ppm - dry wt)							
		Pb	Zn	Cd	Ni	Cu	Mo	V	Cr
10	500 m SW	117	277	1	24	49	<1.2	37	36
12 (Control - Lawn Area)	2.3 km SE	25	69	<1	13	22	<0.2	29	18
12 (Control - Garden Area) ²	2.3 km SE	30	60	<1	11	18	<0.2	33	18
13	1.0 km SW	84	193	1	28	46	<0.2	45	39
14	400 m S	130	273	>1	28	45	<0.6	38	38
15	20 m N	<u>553</u>	<u>560</u>	4	36	<u>102</u>	2.0	44	<u>71</u>
16 (Lawn Area)	10 m N	<u>3100</u>	<u>537</u>	<u>12</u>	41	<u>187</u>	1.4	41	<u>60</u>
16 (Garden Area) ²	10 m N	<u>810</u>	<u>560</u>	<u>5</u>	44	<u>104</u>	1.0	45	<u>59</u>
17	225 m E	177	333	2	26	63	<0.7	39	46
18	300 m E	170	297	2	25	87	<0.4	37	43
Phytotoxicology Upper Limit of Normal (ULN) Guidelines for 0-5 cm urban soil.		500	500	4	60	100	3	70	50

¹Mean concentration of triplicate analysis.

²Samples obtained from 0-15 cm depth - disturbed soil.

Underlined data exceed ULN guideline.

TABLE: 1 (cont'd)

Survey Site Number	Distance & Direction from Welco	Co	Concentration (ppm - dry wt)				
			Mn	Al ¹ (%)	Sr	Fe ¹ (%)	Na
10	500 m SW	10	<u>813</u>	1.6	79	2.9	140
12 (Control) (Lawn Area)	2.3 km SE	6	523	1.1	19	1.8	82
12 (Control) (Garden Area)	2.3 km SE	4	353	1.0	32	1.6	137
13	1.0 km SW	9	<u>760</u>	1.9	88	2.9	180
14	400 m S	8	<u>907</u>	1.7	48	2.6	177
15	20 m N	7	<u>1733</u>	1.5	73	3.3	280
16 (Lawn Area)	10 m N	8	<u>1369</u>	1.5	73	3.3	280
16 (Garden Area)	10 m N	9	<u>1333</u>	1.6	103	<u>3.7</u>	257
17	225 m E	8	<u>1200</u>	1.6	75	2.6	227
18	300 m E	7	<u>1167</u>	1.6	53	2.5	603
Phytotoxicology Upper Limit of Normal (ULN) Guidelines for 0-5 cm urban soil.		25	700	NG	NG	3.5%	NG

¹Aluminum and iron concentrations - percent (%) - dry weight.

Underlined data exceed ULN guideline.

NG - No ULN guideline established.

Table: 2 **Electrical Conductivity and pH of Soils Collected**
in the Vicinity of Welco Precision Weights, Hamilton - 1991

Sample Site Number	Distance & Direction from Welco	Electrical Conductivity	pH
10	500 m SW	0.39	6.26
12 (Control) (Lawn Area)	2.3 km SE	0.26	6.70
12 (Control) (Garden Area)	2.3 km SE	0.15	7.08
13	1.0 km SW	0.24	7.12
14	400 m S	0.28	6.81
15	20 m N	0.33	6.42
16 (Lawn Area)	10 m N	0.31	6.93
16 (Garden Area)	10 m N	0.25	6.78
17	225 m E	0.23	6.31
18	300 m E	0.30	6.01

Electrical Conductivity is millisiemens/cm.

Data are average of triplicate analysis.

INTERPRETATION OF ELECTRICAL CONDUCTIVITY VALUES

Conductivity Reading	Rating	Plant Response
0 - 0.25	L	Suitable for most plants.
0.26 - 0.45	M	Suitable for most plants.
0.46 - 0.70	H	May reduce emergence and cause slight to severe damage to salt sensitive plants.
0.71 - 1.00	E	May prevent emergence and cause slight to severe damage to most plants.
1.00	E	Expected to cause severe damage to most plants.

APPENDIX I

Derivation and Significance of MOE "Upper Limits of Normal" Contaminant Guidelines

The MOE "upper limits of normal" contaminant guidelines essentially represent the expected maximum concentration of contaminants in surface soil (non-agricultural), foliage (tree and shrub), grass, moss bags and/or snow from areas of Ontario not subject to the influence of point source emissions. "Urban" guidelines are based upon samples collected from centres of minimum 10,000 population. "Rural" guidelines are based upon samples collected by MOE personnel using standard sampling techniques (ref: Ministry of the Environment, 1983. Field Investigation Manual. Phytotoxicology Section - Air Resources Branch: Technical Support Sections - NE and NW Regions). Chemical analyses were performed by the MOE Laboratory Services Branch.

The guidelines were calculated by taking the arithmetic mean of available analytical data and adding three standard deviations of the mean. For those distributions that are "normal", 99% of all contaminant levels in samples from "background" locations (i.e. not affected by point sources nor agricultural activities) will lie below these upper limits of normal. For those distributions that are non-normal, the calculated upper limits of normal will not actually equal the 99th percentile, but nevertheless they lie within the observed upper range of MOE results for Ontario samples.

It is stressed that these guidelines do not represent maximum desirable or allowable levels of contaminants. Rather, they serve as levels which, if exceeded, would prompt further investigation on a case by case basis to determine the significance, if any, of the above normal concentration(s). Concentrations which exceed the guidelines are not necessarily toxic to plants, animals or man. Concentrations which are below the guidelines are not known to be toxic.

FIGURE: 1

Soil Survey Site Locations in the Vicinity of Welco Precision Weights,
563 Kenilworth Avenue North, Hamilton - 1991.

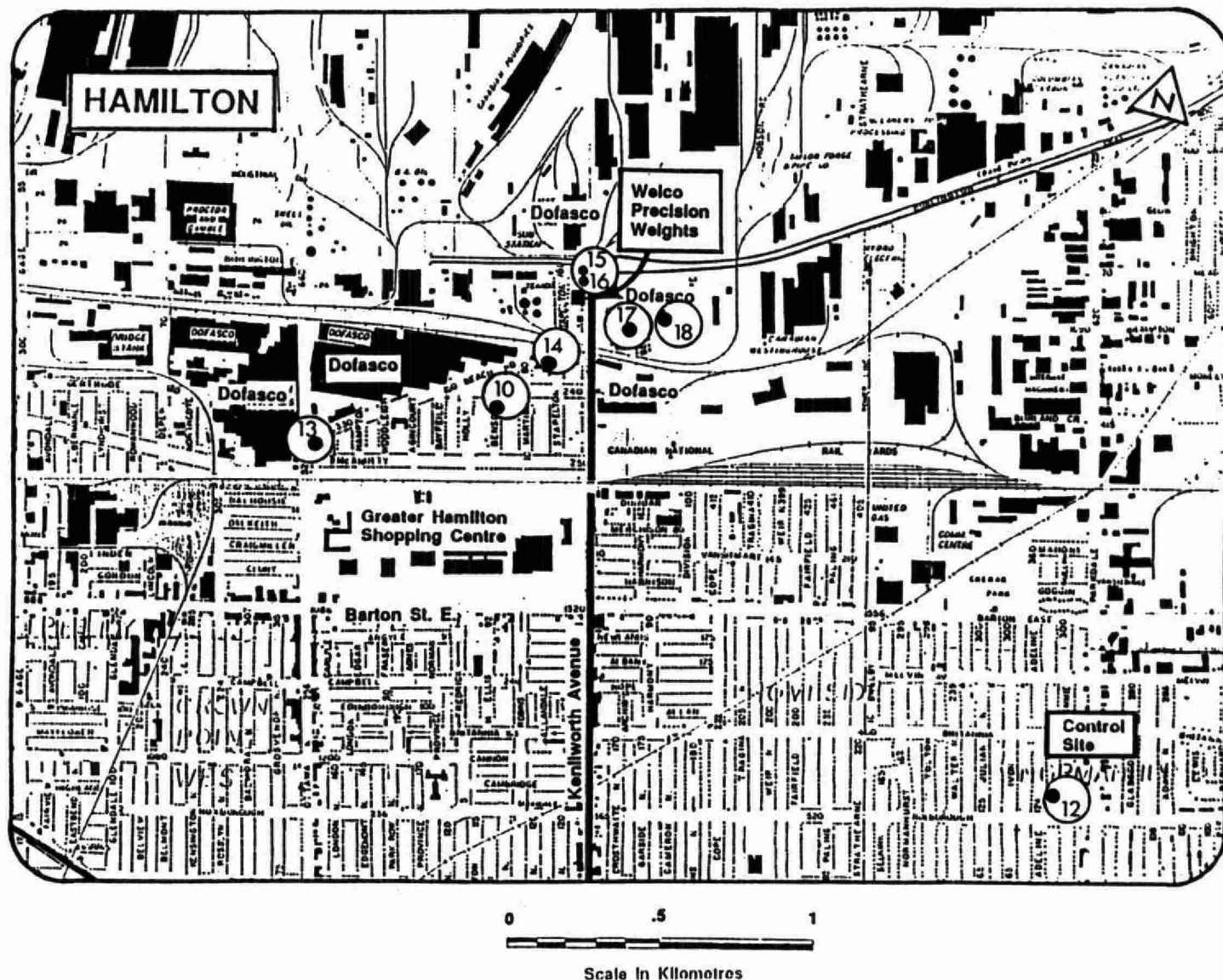
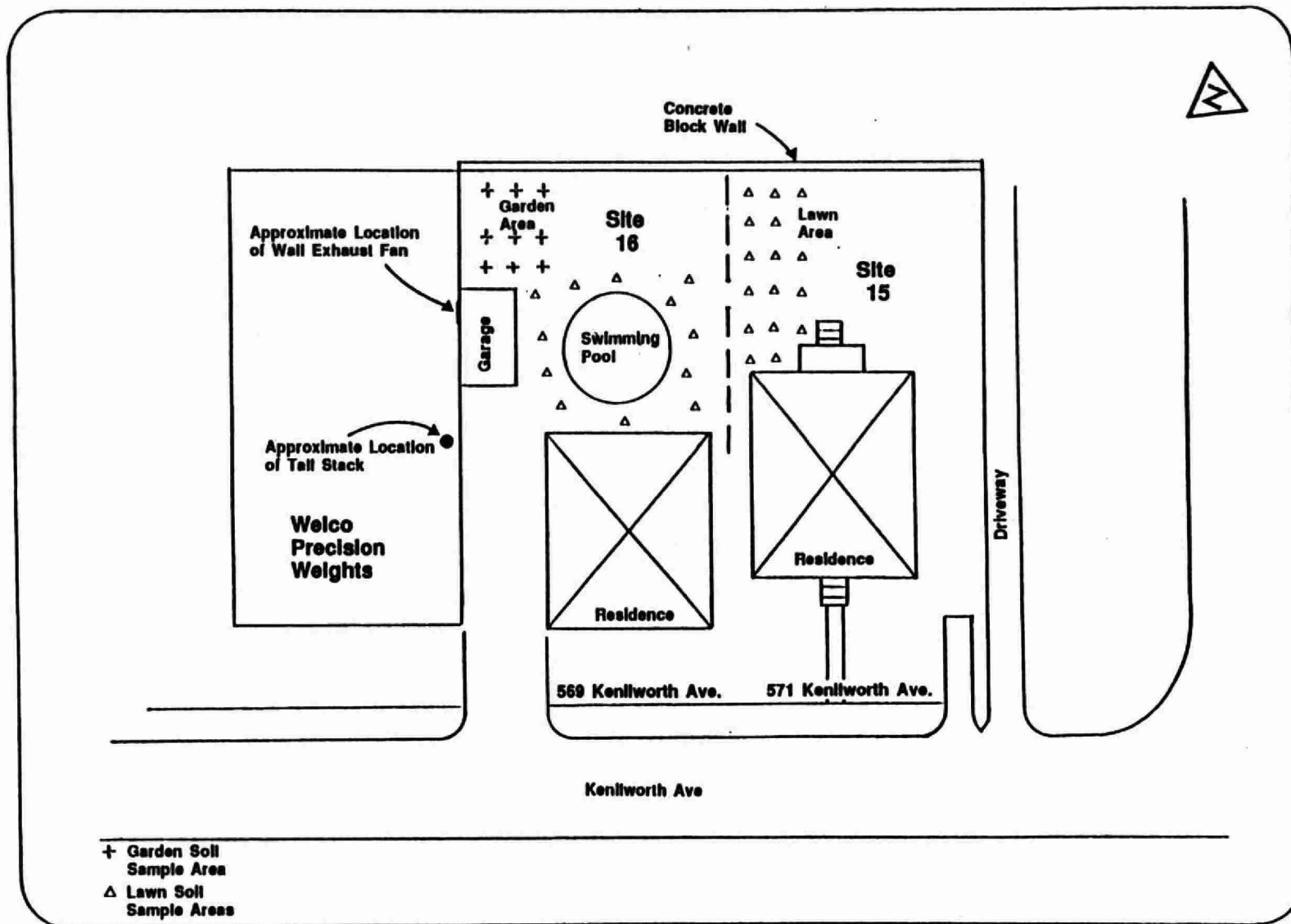


FIGURE: 2

Lawn and Garden Soil Sample Locations at Survey Sites 15 and 16
Situat Adjacent to Welco Precision Weights, Hamilton - 1991.



Sketch Not To Scale



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